

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-241284

(43)Date of publication of application : 30.08.1994

(51)Int.Cl.

F16H 1/32

(21)Application number : 05-024445

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(22)Date of filing : 12.02.1993

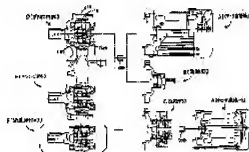
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(54) TRANSMISSION SERIES WITH INTERNAL MESHING PLANETARY GEAR STRUCTURE

(57)Abstract:

PURPOSE: To actualize those of being lighter in weight, compact in size and high steeliness as well as to make multifarious combinations easily obtainable at the time of promoting a series of reduction gears adopted with an internal meshing planetary gear structure.

CONSTITUTION: A reduction gear mechanism part is supported inboard on a casing 112 via a pair of bearings 115a and 114b, while a range of up to these paired bearings 115a, 115b is set to a reduction gear part pack F and unitized as one body. In addition, this reduction gear part pack F is housed in an internal gear 110 and, in turn, this internal gear 110 is unified with the casing 112, and further a planetary gear structural part D or E, inclusive of an output shaft cover too, are unitized. Likewise, those of input side portions A1, A2, B and C are also unitized respectively, and at the same frame number, respective ones are made so as to be optionally combined together via a joint spline 200.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the series of the gearbox which adopted inner gearing planetary gear structure.

[0002]

[Description of the Prior Art]The external gear attached to this 1st axis in the state in which eccentric rotation is possible via the eccentric body conventionally provided in the 1st axis and this 1st axis, The inner gearing planetary gear structure provided with the internal gear in which this external gear carries out inscribed engagement, and the 2nd axis connected with said external gear via a means to transmit only the rotational components of this external gear is known widely.

[0003]The conventional example of this structure is shown in drawing 12 and drawing 13. Use said 1st axis as an input shaft, and it uses the 2nd axis as an output shaft, and this conventional example applies the above-mentioned structure to "reduction gears" by fixing an internal gear.

[0004]The eccentric body 3 has fitted into the input shaft 1 via the key 30. The external gear 5 is attached to this eccentric body 3 via the bearing 4. Two or more internal roller holes 6 were formed in this external gear 5, and the inner pin 7 and the internal roller 8 have fitted in.

[0005]The external teeth 9, such as a trochoid tooth profile and a circle tooth profile, are formed in the periphery of said external gear 5. Inscribed engagement of this external tooth 9 is carried out with the internal gear 10 fixed to the casing 12. The outside pin 11 fits loosely into the outside pin hole 13, and specifically let the internal tooth of the internal gear 10 be the structure which was easy to rotate and was held.

[0006]The inner pin 7 which penetrates said external gear 5 has adhered to the flange 14 of the output shaft 2.

[0007]If the input shaft 1 rotates one time, the eccentric body 3 will rotate one time. Although the external gear 5 also tries to perform rocking rotation around the input shaft 1 by one rotation of this eccentric body 3, since that rotation is restrained by the internal gear 10, the external gear 5 will only rock almost, being inscribed in this internal gear 10.

[0008]When the number of teeth of N and the internal gear 10 is set to N+1 for the number of teeth of the now 5, for example, external gear, the difference of gear teeth number is 1. Therefore, the

external gear 5 becomes what is shifted by one gear tooth to the internal gear 10 fixed to the casing 12 (it rotates) for every rotation of the input shaft 1. This means what one rotation of the input shaft 1 was slowed down for by the rotation which is $-1/N$ of external gear N .

[0009] That rocking ingredient is absorbed by the crevice between the internal roller hole 6 and the inner pin 7, and, as for rotation of this external gear 5, only rotational components are transmitted to the output shaft 2 via this inner pin 7 by it.

[0010] In here, the internal roller hole 6 and the inner pin 7 (internal roller 8) form the "uniform internal-gear mechanism."

[0011] As a result, the slowdown of moderating ratio $-1/N$ is attained after all.

[0012] Although the internal gear of the inner gearing planetary gear structure concerned is fixed, the 1st axis is used as an input shaft and the 2nd axis is used as the output shaft, the 2nd axis can be fixed and reduction gears can consist of this conventional example also by using the 1st axis as an input shaft and using an internal gear as an output shaft. It is also possible by reversing these input and output to constitute a speed-increasing gear.

[0013] Although this conventional example is a structure which carries out floor installation of the whole reduction gears, as the structure which formed the installation flange 36 in this and was considered as flange attachment is also shown in drawing 14, it is publicly known. Identical codes are substantially given to identical parts.

[0014] By the way, as mentioned above, the inner pin 7 has the function to form the circle tooth profile which is one element of the uniform internal-gear mechanism which comprises the internal roller hole 6, and a function as carrier bodies which transmit the torque by rotation of the external gear 5 to the output shaft 2, but. In order to secure the function of the former of these good especially, existence of the internal roller 8 which can rotate freely on the periphery of the inner pin 7 was indispensable. a raw material that function top hard in this internal roller 8 -- the both sides of that periphery and inner circumference -- the same axle -- and since it needed to be processed with sufficient accuracy, there was a problem of being easy to become a high cost.

[0015] Then, among these, the function to form the circle tooth profile which is one element of the uniform internal-gear mechanism of the pin 7, The function as carrier bodies which transmit the torque by rotation of the external gear 5 to the output shaft 2 is separated, and if it has this internal roller 8 even if it loses the internal roller 8, the thing which enabled it to obtain the same performance is proposed (publication of unexamined utility model application Showa 59-127951).

[0016] This structure is shown in drawing 15 and drawing 16. The same numerals are substantially given to the same portion also here.

[0017] The inner pin hole (equivalent to an internal roller hole) 19a which provided this structure in this external gear 5a and 5b as a means to transmit the rotational components of external gear, and the inner pin 7 which can constitute a uniform internal-gear mechanism to 19b, It projects from the circular retaining ring 17 which receives rotation of the external gear rotational components of this inner pin 7, and the flange 14 formed in the output shaft 2, and has said retaining ring 17 and the carrier object 16 connected and fixed.

[0018] External gear is made into two sheets (double row) in order to mainly aim at increase of transmission capacity, strong maintenance, and maintenance of rotational balance. The external gear

5a and the eccentric direction of 5b have shifted about 180 degrees of phases.

[0019]Said inner pin 7 is inserted in said flange 14 and the retaining ring 17 via the bush 18a and 18b, respectively, enabling free rotation. That is, among these, since the pin 7 does not need to be firmly connected with the output shaft 2 by existence of the carrier object 16, it can be considered as the composition which self can rotate and, as a result, can be omitting the conventional internal roller 8. Said circular retaining ring 17 is built into the tip end part of said carrier object 16.

[0020]Since the carrier object 16 should have only the function to transmit the torque of the retaining ring 17 to an output shaft, the through hole 20a only with larger only not interfering with this carrier pin 16, even if it rocks, and 20b are provided in the external gear 5a and the corresponding point of 5b.

[0021]A steel plate bearing ring and 23 are inner pin tap bolts an inner pin pressure plate for the numerals 15a and 15b to carry out the bearing of the output shaft 2, and for 21 position the shaft orientations of the inner pin 7 in drawing 15, and 22.

[0022]By the way, epicyclic gear structure of an inscribed engagement type which was mentioned above can change a moderating ratio freely only by changing the external gear 5a, 5b, the internal gear 10, the outside pin 11 and the eccentric body 3a, and 3b.

[0023]therefore, the subseries (this subseries is called henceforth a "frame number") which doubled with the request of the commercial scene the connection size to the mate machine decided by the size of the output shaft 2 and the casing 12, and was divided into several kinds of sizes from so-called smallness to a so-called size being prepared beforehand, and, Correspondence to various users is enabled by systematizing beforehand and preparing several kinds of change gear ratios in the same frame number.

[0024]If it is in a publicly known thing concretely, the combination of $1/6 - 1/119$, and a motor is prepared for the moderating ratio by the frame number of plurality [output torque / 0.1kw - 132kw, and / thing / of 0.35kgm - 6000kgm].

[0025]

[Problem(s) to be Solved by the Invention]However, such conventional reduction gears so that clearly from drawing 12, drawing 14, and drawing 15, Since the external radial road from the mate machine which acts on the load variation produced in a deceleration mechanism portion or the output shaft 2 was supported by the bearing 15a of the couple supporting the output shaft 2, and 15b, In order to increase the stability of support, it was required to shorten X section for Y section of each figure as much as possible for a long time generally.

[0026]However, since it was difficult to shorten X section, Y section had to be lengthened inevitably and there was a problem that the shaft-orientations length of reduction gears will become long as a result.

[0027]Since the carrier object 16 was formed in the output shaft 2 and one if it was in the structure shown in drawing 15 and drawing 16, manufacture was very difficult, and became a high cost, and the problem that the cost reduction effect by having omitted the internal roller 8 will be reduced also had it.

[0028]On the other hand, also in the structure of drawing 14 which considered the reduction gears of drawing 12 and drawing 13 as flange attachment, the above problem exists as it is, and. Since the casing 12 needed to take the long section Y and the distance Z of the installation flange 36 to a mate

machine and the flange 37 for internal-gear attachment had become long double flange structure, For example, when manufacturing with aluminum die casting or an aluminium casting, the mold became complicated and it was hard to carry out manufacture, and there was also a problem of becoming a high cost.

[0029]The structure shown in drawing 12 and drawing 13, Since it is the method of all accumulating the eccentric body 3, the bearing 4, the external gear 5, and the internal gear 10 on the motor constituted including the casing 12 and the input shaft 1, and fixing them with a bolt, must separate a motor section and a gear-reducer part, must decompose into exchanging motors, and the whole The result, There were also the following problems. That is, in the field (for example, field of a physical distribution system) which uses such a GIYADO motor in recent years, various performances are increasingly required of the motor adopted according to the use. Even if it has the same horsepower, for example, a general mere induction motor, Very various motors including the control circuit which ** the motor etc. which were formed into full water proof, and is attached are increasingly used for a motor with a brake, the motor whose revolving speed control is possible with the constant torque which has an inverter control circuit, and the improvement in safety.

[0030]Then, the thing for which the assembly by the motor of a GIYADO motor can be performed in a short time at the time of an assembly, And importance is dramatically attached to it being actually included, for example in a physical distribution system, and a motor in use being exchanged in a short time. It becomes impossible to say it to be able to satisfy a demand of this time enough that the whole must be decomposed when exchanging motors, as mentioned above.

[0031]This invention is made in view of such a conventional problem, and carries out unitization of the inner gearing planetary gear structure part with a reducing part pack first, By carrying out unitization of an inner gearing planetary gear structure part, a motor section, or the input-shaft part of both shaft shapes, exchange of decomposition, an assembly, and a motor is carried out to preparation, and it sets it as the purpose to solve an aforementioned problem.

[0032]

[Means for Solving the Problem]External gear attached to this 1st axis in the state in which eccentric rotation is possible via an eccentric body which provided this invention in the 1st axis and this 1st axis, An internal gear in which this external gear carries out inscribed engagement, and the 2nd axis connected with said external gear via a means to transmit only rotational components of this external gear, An inner pin which can constitute a uniform internal-gear mechanism as a means to transmit a preparation and said rotational components, to an internal roller hole provided in said external gear, A circular retaining ring which receives rotation of external gear rotational components of this inner pin, In series of a gearbox which adopted inner gearing planetary gear structure which is projected from a flange formed in said 2nd axis, and has said retaining ring and the carrier bodies connected and fixed, On both sides of said external gear, arrange a flange of said circular retaining ring and the 2nd axis, and. Enable support of this retaining ring and both sides of a flange to a casing via a bearing of a couple, and carry out unitization by considering a portion pinched by bearing of this couple as a speed change part pack, and. Store this speed change part pack in said internal gear, and by uniting this internal gear with a casing, carry out unitization of the epicyclic gear structured division, and unitization of the input side parts, such as a motor section and an input-shaft case part, is carried out

further, An aforementioned problem is solved by having enabled connection of this by said epicyclic gear structured division, a ** spline, etc.

[0033]In the same frame number, an aforementioned problem is solved by making the same a **** size of said epicyclic gear structured division and an input side part.

[0034]

[Function]In this invention, what is called not gear-pair-with-parallel-axes structure but inner gearing planetary gear structure are adopted fundamentally, A carrier object is penetrated on it, external gear is arranged, and he inserts this external gear by the flange of a circular retaining ring and the 2nd axis, and is trying to support this retaining ring and the both sides of a flange to a casing via the bearing of a couple. as a result, it can be small, and a high change gear ratio (moderating ratio in order to use as reduction gears generally) can be obtained easily, and also the rigidity of this speed change mechanism part, the rigidity especially to a radial direction, and stability can be boiled markedly, and it can be made to improve

[0035]Unitization of both the input-side portions to the epicyclic gear structured divisions, such as the epicyclic gear structured division, a motor section, an input-shaft case part, is carried out, by a ** spline, this is written as connection is possible, and a disassembling motor, an assembly, and exchange become easy.

[0036]Therefore, the flexibility in the case of adopting a motor various type according to a use in the field (for example, field of a physical distribution system) which uses a GIYADO motor becomes large, and a physical distribution system etc. can also perform now motor exchange of a geared motor in use easily actually.

[0037]

[Example]Hereafter, based on a drawing, the example of this invention is described in detail.

[0038]Drawing 1 is an entire configuration figure of the series of the reduction gears with which the inner gearing planetary gear structure concerning this invention was adopted, and the enlarged drawing of each component part and drawing 9 of drawing 2 - drawing 8 are the IX-IX line sectional views of drawing 6.

[0039]In the following explanation, lower 2 figure shall attach the same number about the composition of a well-known example, and an identical or similar portion conventionally.

[0040]In drawing 6 and drawing 9, the end of the carrier pin (carrier object) 116 used as the separate member is inserted in the flange 114 of the output shaft 102 in this flange 114 (press fit). The retaining ring 117 is inserted in the other end of this carrier pin 116 (press fit), and the carrier is constituted by this retaining ring 117 and the carrier pin 116.

[0041]Both **** support of the flange 114, the carrier pin 116, and the retaining ring 117 is carried out by the bearing 115a of a couple, and 115b at the casing 112.

[0042]the carrier pin 116 -- the -- the spacer 125 of pipe shape is mostly inserted in the center (press fit). Therefore, even if the retaining ring 117 of the carrier pin 116 or the insertion depth to the flange 114 has some dispersion, The distance of the retaining ring 117 and the flange 114 is certainly uniformly maintained with the function of this spacer 125, and the same distance can be easily secured in the portion of all the carrier pins 116 which moreover exist four.

[0043]The carrier pin hole (through hole) 120 which the carrier pin 116 penetrates is formed in the

external gear 105a and 105b. Even if the external gear 105a and 105b rock this carrier pin hole 120, let it be a size which the carrier pin 116 and the external gears 105a and 105b do not contact in addition.

[0044]The internal gear 110 is united with the casing 112, and this casing 112 is further united with the output-shaft covering 112a.

[0045]Unitization of the deceleration mechanism part is carried out as the reducing part pack F so that it may mention later, and it is accommodated in the internal gear 110.

[0046]The inner pin 107 is pressed fit in the retaining ring 117 and the flange 114. Therefore, free rotation is impossible. However, the thing for which processing of mirror plane finish can be made easy for a hard raw material since [with simple shape of the pin in **] it is cylindrical (to low cost), ** Since the bearing 115a of a couple and structure which carries out both **** support on both sides of a deceleration mechanism by 115b were adopted, Since the whole rigidity's being improved dramatically and the inner pin's 107 being supported in the state it having been stabilized extremely, and the composition further divided into the pin 107 in ** and the carrier pin 116 were taken, It comes to take charge of the radial road which flows from an output shaft etc. in the direction of the carrier pin 116, and since there is no possibility that a strong radial road may be applied in the inner pin 107, even if it omits an internal roller practically from the ability to support in the state where it was stabilized further, there is no problem in particular. Among these, the pin 107 is not press fit and it may be made to make it however, fit in loosely.

[0047]It is shown that drawing 1 systematized as series the composition of combining each member of motor direct connection type, both shaft shape, and two-step type to the epicyclic gear structured division of leg attachment type and a flanged end, within the same frame number. It is indicated to drawing 2 - drawing 8 that the enlarged drawing of each part mentioned above.

[0048]Here, the motor direct connection type A1 and A2 are for making what is called a GIYADO motor constitute, and they are for making a motor and an epicyclic gear style part connect in one.

[0049]It is for both the shaft shapes B connecting driving sources (motor etc.) with the input shaft 101 by coupling etc. Both this shaft shape is also called the reducer.

[0050]Two-step type C is for obtaining large slowdown-ization combining epicyclic gear structure to two steps.

[0051]These input-side portions are connected with the input shaft 101 of the epicyclic gear structured division via the ** spline 200. For this reason, in the same frame number, the **** size of an input-side portion and the epicyclic gear structured division is made the same in this product group.

[0052]As the epicyclic gear structured division, the leg attachment type D and flanged-end E are prepared. Leg attachment type D is as using it, when installing to a mate machine and installing to a mate machine in the leg-flanges part 150, and having already explained for details. Flanged-end E is used when installing to a mate machine in the flange 152 formed in the axis and the perpendicular direction.

[0053]The measures against an oil seal are taken and the connection size with said ** spline 200 is communalized so that unitization of each component part A-E of all may be carried out and stock, conveyance, etc. can be performed convenient alone, respectively.

[0054]The reducing part pack F is what took out and carried out unitization only of the deceleration

mechanism part of epicyclic gear structure, and is used common to the leg attachment type D and flanged-end E. Since unitization of this portion is carried out, the moderating ratio within the same frame number can be changed very easily.

[0055]Although the example of a figure of drawing 1 (drawing 2 - drawing 8) shows one example and is not illustrating it, even if it has the same horsepower, for example about the motor direct connection type A1 and A2, Various motors including the control circuit which ** the motor etc. which were formed into full water proof, and is attached are prepared for a general mere induction motor, a motor with a brake, the motor whose revolving speed control is possible with the constant torque which has an inverter control circuit, and the improvement in safety. Similarly, some variations are prepared about other component part B-E. About the reducing part pack F, some variations from which a moderating ratio differs are prepared.

[0056]What combined the leg attachment type D, the ** spline 200, and the motor direct connection type A1 is shown in drawing 10 as an example of combination. What combined the leg attachment type D, the two-step type C, the ** spline 200, and the motor direct connection type A2 as an example of other combination is shown in drawing 11.

[0057]Next, an operation of this example is explained.

[0058]With reference to drawing 6 and drawing 9, the external gear 105 carries out rocking rotation with rotation of the input shaft 101 again, It is completely the same as that of the conventional well-known example that rotation of the input shaft 101 turns into rotation (rotation) by which the external gear 105 was slowed down by engagement with the outside pin 111 and the external gear 105 equivalent to the internal tooth of the internal gear 110.

[0059]That rocking ingredient is absorbed by the crevice between the inner pin hole (equivalent to an internal roller hole) 119, and the inner pin 107, and, as for rotation of this external gear 105, only rotational components are transmitted to the flange 114 and the retaining ring 117 of the output shaft 102 via this inner pin 107. The torque transmitted to the retaining ring 117 is transmitted to the output shaft 102 via the carrier pin 116.

[0060]Since the external radial road which acts on the output shaft 102 is thought to be the bearing 115a by both **** by the bearing 115a via the carrier pin 116 and the retaining ring 117, an external radial road does not influence the inner pin 107.

[0061]As a result, since the burden of the inner pin 107 becomes very small and the shape of this inner pin 107 can be simplified extremely, highly precise processing can be easily realized for a hard raw material, and even if he has no internal roller, good "uniform internal-gear mechanism" can be constituted. By existence of the carrier pin 116, this inner pin 107 becomes able [self] to rotate, and to incorporate it, as loosely-fitting structure, i.e., self, obtains this, and can realize in this case still smoother "uniform internal-gear mechanism."

[0062]Input side part A-C, such as the epicyclic gear structured divisions D and E and a motor, can perform an assembly, decomposition, and exchange easily combining each unit.

[0063]

[Effect of the Invention]According to this invention, since both **** support of the deceleration mechanism part is carried out by the bearing of the couple, the overall length of this reduction gear part can be shortened, and attachment of high degree of accuracy and high rigidity can be performed,

as explained above.

[0064]Since unitization of the epicyclic gear structured division and the input side parts, such as a motor, is carried out respectively, combination with the motor according to a use can be chosen easily and assembly time also ends short, quick delivery correspondence is attained, and work becomes easy also when exchanging motors during use as a GIYADO motor.

[0065]Since unitization of the reducing part pack is carried out, the moderating ratio change in a frame number is also easy.

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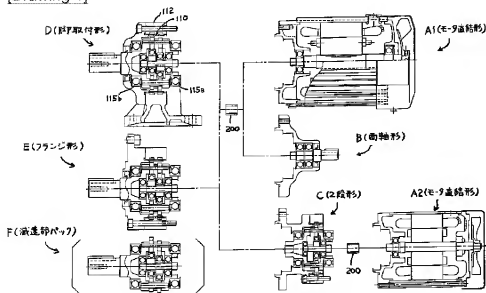
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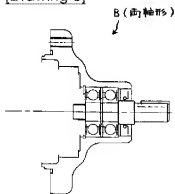
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DRAWINGS

[Drawing 1]

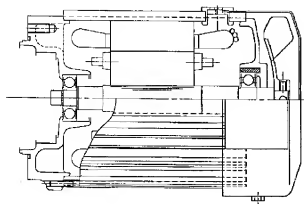


[Drawing 3]



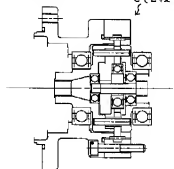
[Drawing 2]

A1 (モータ直結形)



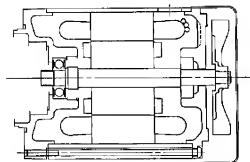
[Drawing 4]

C (2段形)

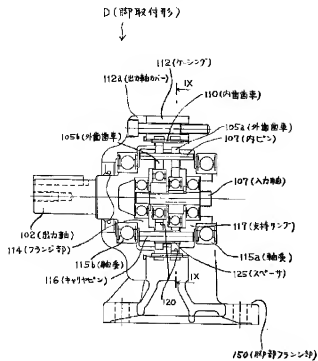


[Drawing 5]

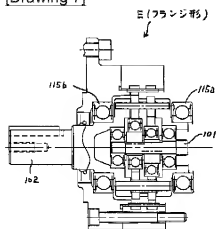
A2 (モータ直結形)



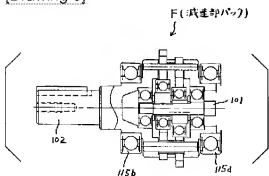
[Drawing 6]



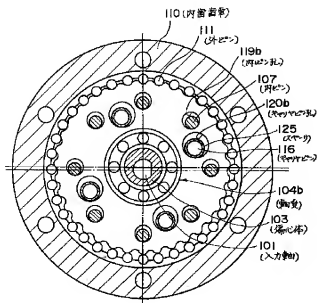
[Drawing 7]



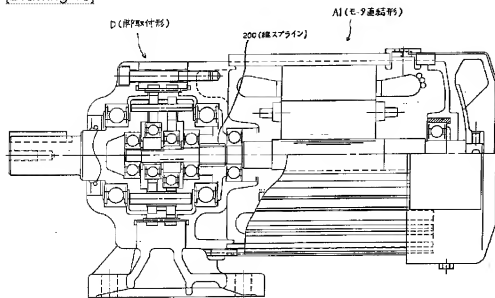
[Drawing 8]



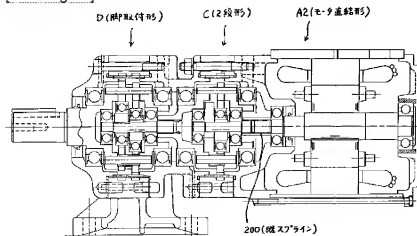
[Drawing 9]



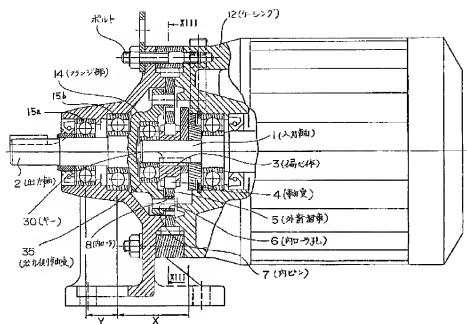
[Drawing 10]



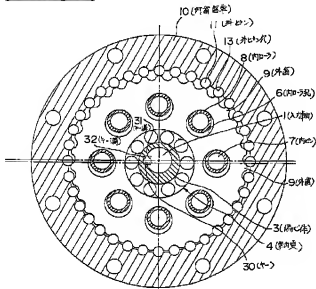
[Drawing 11]



[Drawing 12]



[Drawing 13]



[Drawing 14]

